

# Cognitive Engine enabled Mission-aware Intelligent Communication System for Space Networking, Phase I

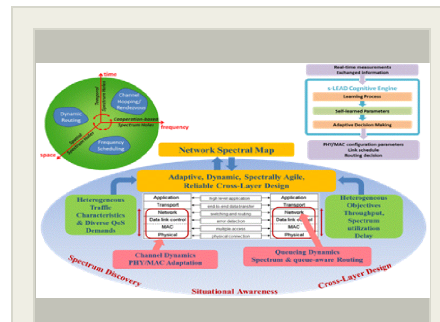
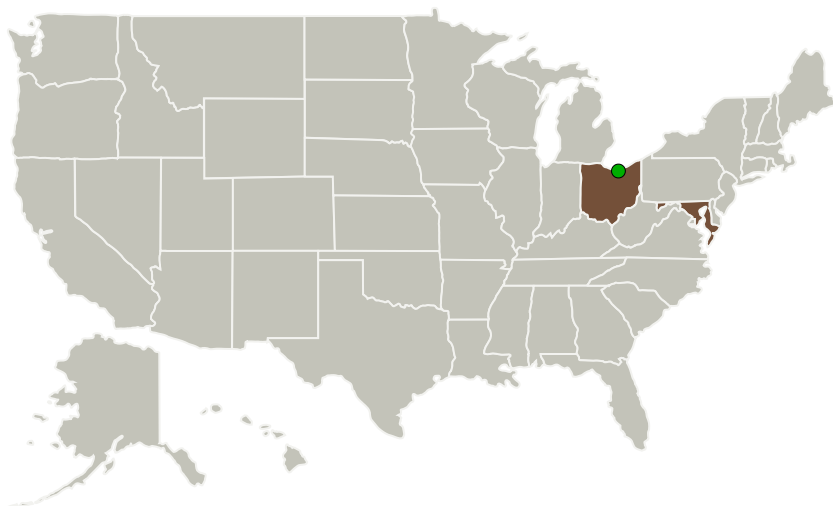
Completed Technology Project (2015 - 2015)



## Project Introduction

Cognitive radio technology provides spectrum agility to increase the level of cognition and automation. However, spectrum agility alone is not enough to achieve reliable communications for space networks. Mission success often requires network agility across the protocol layers for environmental awareness and autonomous reconfiguration. This is still an unsolved problem. Specifically, multi-hop wireless/satellite networks with dynamic radio spectrum calls for the development of novel spectrum-aware routing and scheduling algorithms. Most recent work has focused on traditional wireless networks. The effort is still at an early stage and their results cannot be directly applied to the space networks due to the unique characteristics such as large propagation delay, intermittent and asymmetric links, and limited storage space. Thus, further investigation is needed to understand how and where to apply cognitive and automation technologies to enable the network agility in space networks. To address this critical need, Intelligent Automation Inc. proposes a self-learning and adaptive communication system (s-LEAD) architecture for advanced space networks. The proposed technology builds on the cross-layer optimization framework to enable adaptive and self-optimizing cognitive radio networks capable of responding to environmental changes through joint control of spectrum management, physical-layer cooperation, and traditional networking functionalities. The key innovation of s-LEAD is to develop a reliable and adaptive decision making system with dynamic spectrum access (DSA) capability for hybrid satellite and ground networks with diverse traffic characteristics and quality-of-service (QoS) requirements. Our special focus is on how to enable situational awareness and self-adaptation with multiple objectives of throughput, spectrum utilization, and latency.

## Primary U.S. Work Locations and Key Partners



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## Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
Intelligent Automation, Inc.	Lead Organization	Industry	Rockville, Maryland
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

## Primary U.S. Work Locations

Maryland	Ohio
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## Project Transitions

**June 2015:** Project Start

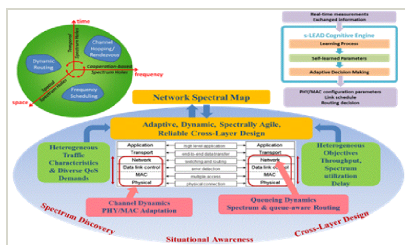
**December 2015:** Closed out

**Closeout Summary:** Cognitive Engine enabled Mission-aware Intelligent Communication System for Space Networking, Phase I Project Image

### Closeout Documentation:

- Final Summary Chart Image(<https://techport.nasa.gov/file/138870>)

## Images



### Briefing Chart Image

Cognitive Engine enabled Mission-aware Intelligent Communication System for Space Networking, Phase I

(<https://techport.nasa.gov/image/127612>)

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Intelligent Automation, Inc.

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

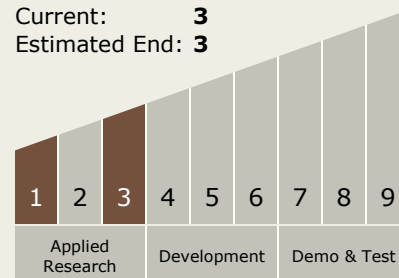
Carlos Torrez

### Principal Investigator:

Lei Ding

## Technology Maturity (TRL)

Start: **1**  
Current: **3**  
Estimated End: **3**



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## Technology Areas

### Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - └ TX05.5 Revolutionary Communications Technologies
    - └ TX05.5.1 Cognitive Networking

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System